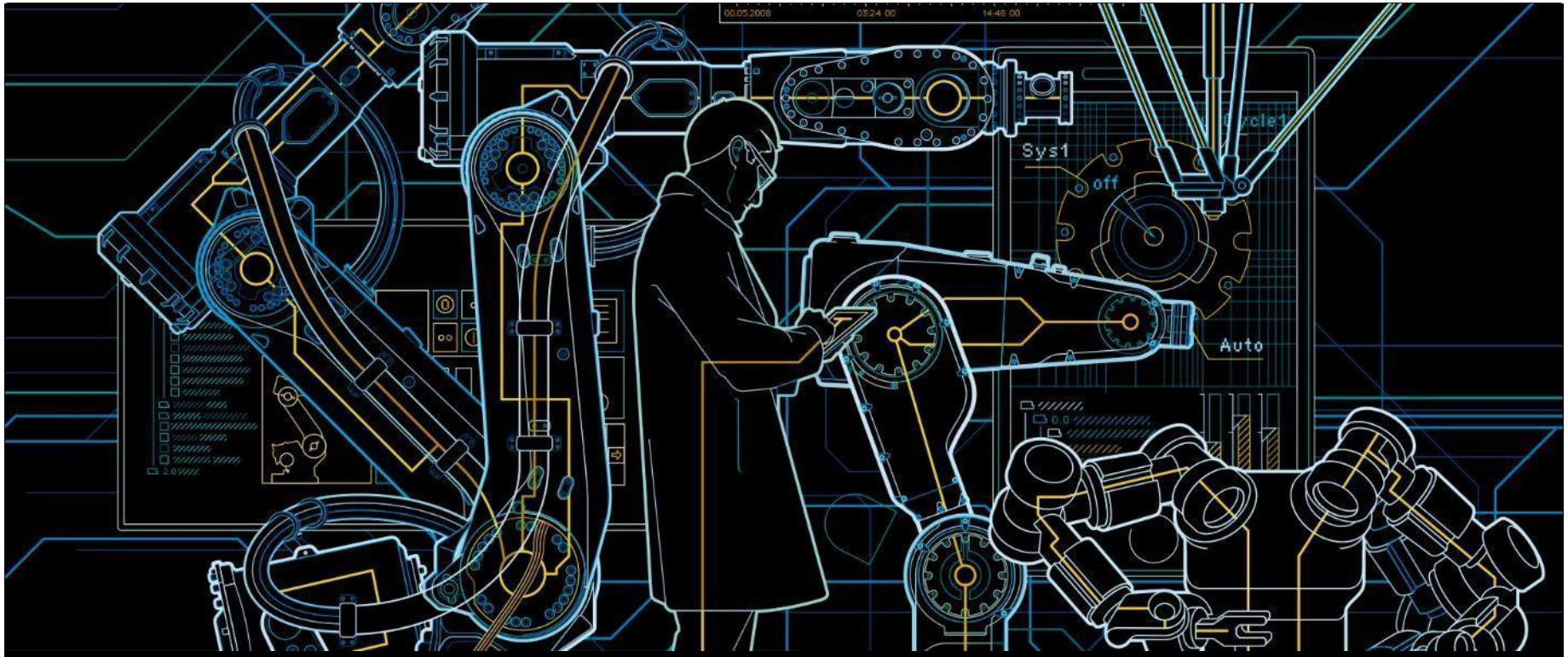


Thomas Fuhlbrigge, Global Program Manager of Next Generation Robotics, ABB Corporate Research, April 2016

Current Uses of Robotics and Teleoperation in Industry

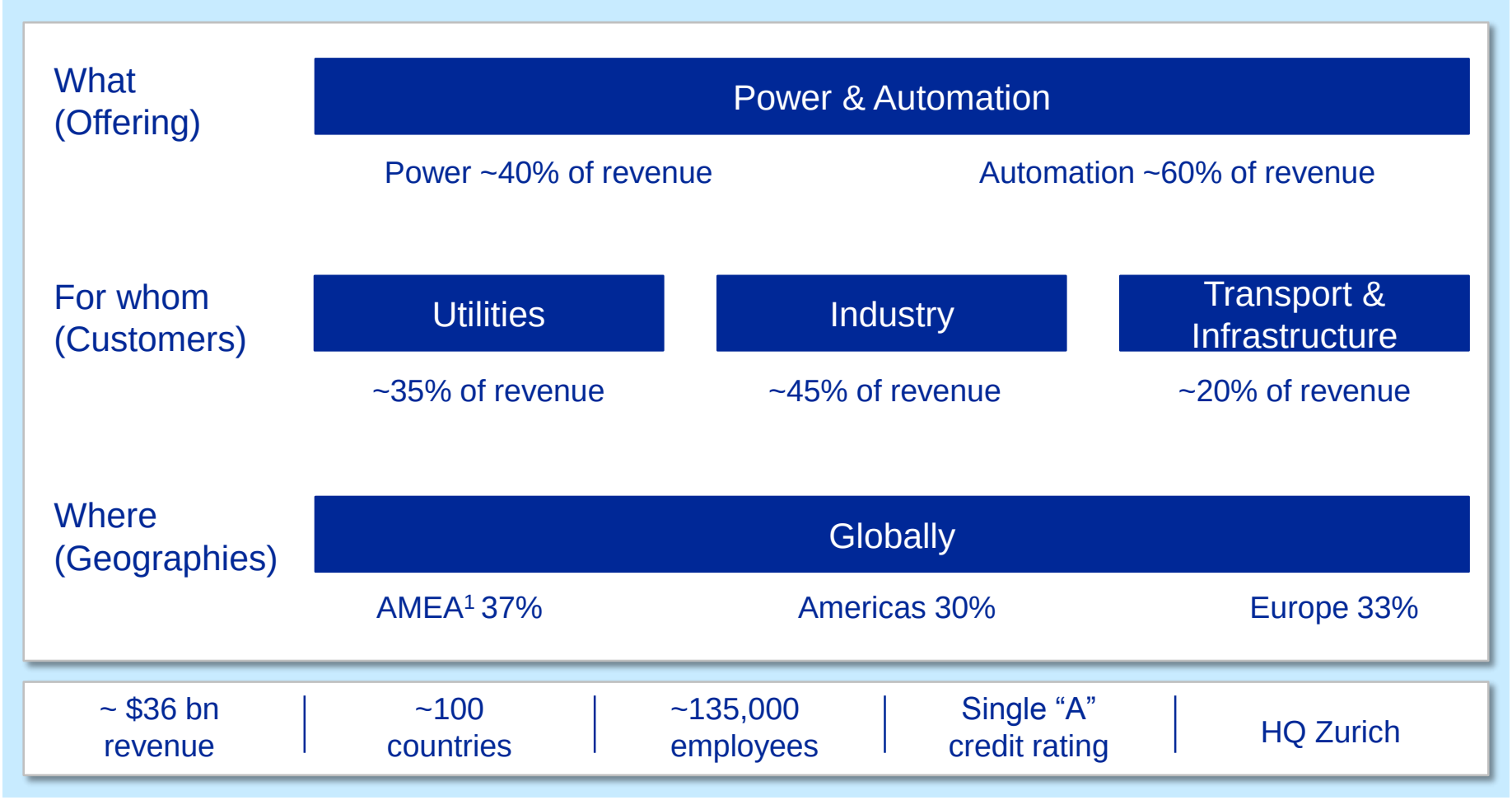
Outline

ABB Group Overview

ABB Robotics Overview

ABB Experience in Robotic Teleoperation

ABB Group
A global leader in power and automation technologies



[1] Asia, Middle East, Africa

ABB Group
Shaping the World through Innovation

+$1.5 bn
Investment annually

~ 8,500 k
Technologists

~ 70
University collaborations

7
Corporate research centers linked by a global research center

Innovation is ingrained in the DNA of ABB

ABB Group
A unique automation portfolio

Robotics

Controllers

Motion controllers

Drive based controllers

AC500 PLC

Drives

Micro

1ph servo

3ph servo / motion drives

AC drives

Motors

Linear motors

Servo motors

AC motors

Accessories

Jokab Safety

HMI + IO

ABB Robotics
Serving 10 Major Market Segments

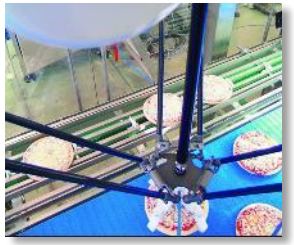
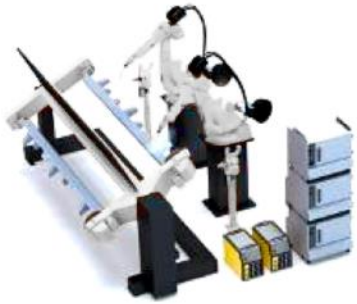
Automotive	Foundry & Forging	Metal Fabrication	Machine Tools	Plastics & Rubber
				
Food & Beverage	Pharmaceuticals	Transportation	Electrical & Electronics	Renewable Energy
				
>250,000 robots	~53 countries	~100 locations	~5,500 employees	Factories in US, Sweden, China

ABB Robotics

Experienced from Over 250,000 Robots Delivered



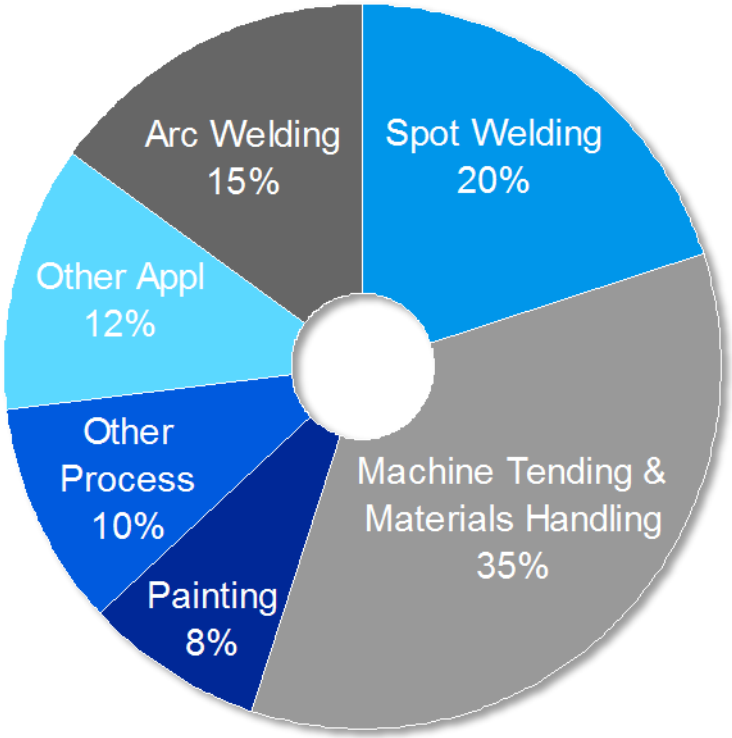


ABB Robotics
Products & Systems Overview

Robots

Comprehensive range with capacity from 500 g to 800 kg

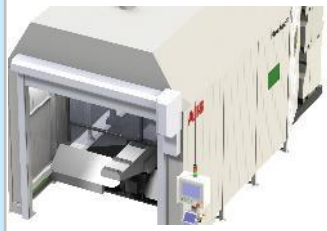
Application Equipment & Accessories

Fully integrated for Welding, Handling, Gluing, Sealing, Painting

Software

To support robots and systems throughout their entire life-cycle

Manufacturing Cells & Function Packages



Modular cells based on globally proven solutions

Automotive Systems

Fully engineered for B-i-W, Paint, Powertrain and Press Automation

ABB Robotics
The ABB Robot Family

Range suitable for a wide range of applications

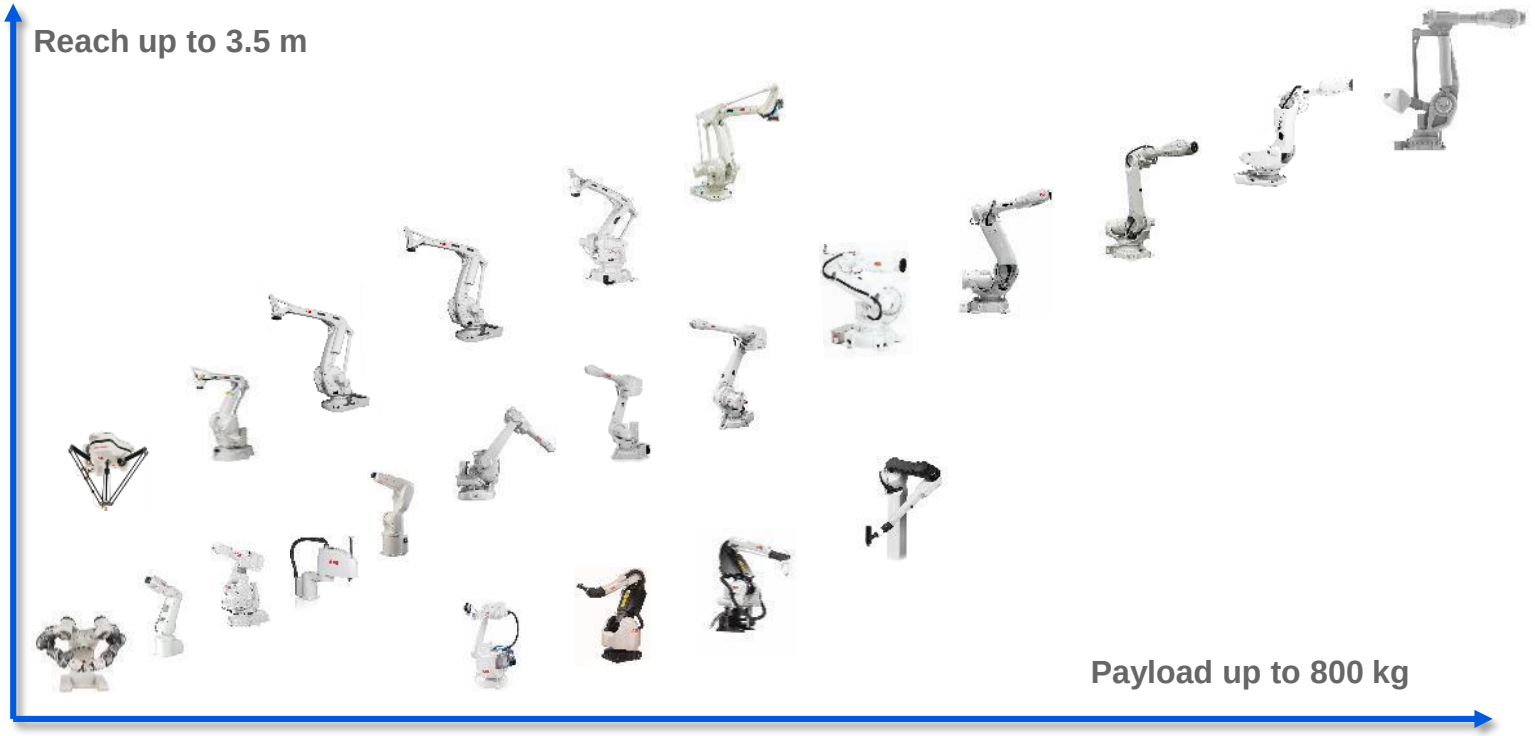


ABB Robotics
Robot-based Manufacturing Cells

FlexArc – Arc Welding Cells

- Graphical interactive HMI on FlexPendant
- Integrated weld error recovery
- Integrated production monitoring
- Intuitive production manager
- Navigator software
  - Cell calibration
  - Tooling calibration
  - Part measurement
  - Cell check
- Free digital replicas of cells in RobotStudio® format

ABB Robotics
Body-in-White Assembly

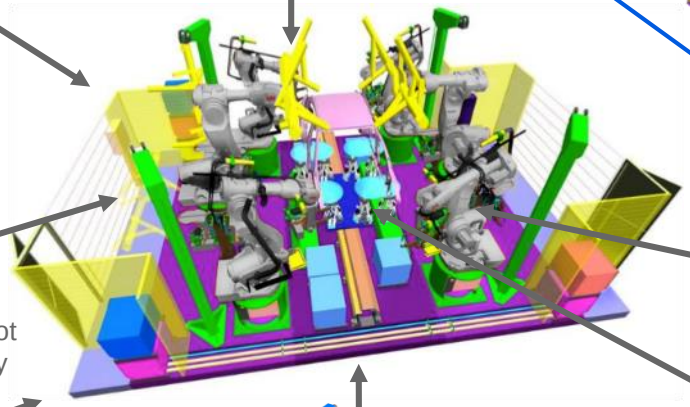
FlexLean – Modular Assembly Line Concepts

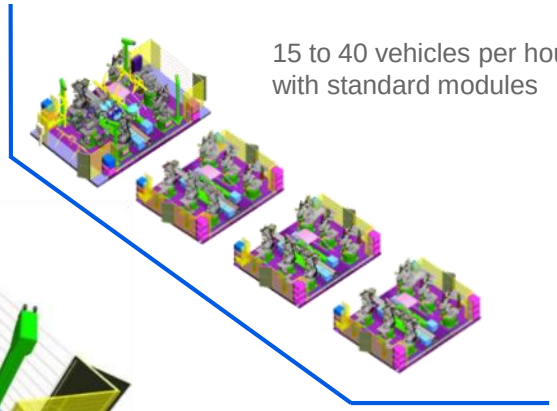
FlexControl
Cell automation in IRC5 enclosure

RPSC
Operator loading directly in robot hand with Robot Position Safety Controller

Flexicell Base
With integrated cabling & piping

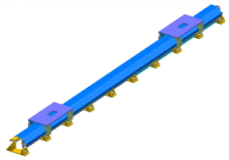
FlexGrip
Programmable end-effectors





15 to 40 vehicles per hour with standard modules

IRB 6620
Dedicated lean spotwelding robot



MH Track
Material handling track motion

FlexPLP
Programmable positioners for part locators

ABB Robotics
Typical Manufacturing Cell

ABB TPW Cell Ford Sterling Axle

http://www.gettyimages.com/detail/news-photo/an-employee-watches-as-a-abb-ltd-automated-robots-work-on-news-photo/450375927

ABB Robotics
Typical Manufacturing Cell

ABB Robotics
Typical Robot Characteristics –big robots

Specification	
Reach	2.2 m
Handling capacity	150 kg
Extra loads can be mounted on to the robot:	50 kg on to the upper and 100 kg on to the robot base.
Number of axes:	6
Protection:	IP 54
	IP 67 with Foundry Plus 2 option
Mounting:	Floor, tilted or inverted
IRC5 Controller variants	Single cabinet

Performance	
Position repeatability:	0.03 mm

MBTF 50,000hrs
8 yr design life
900 kg weight

ABB Robotics
Typical Robot Characteristics –small robots

Specification			
Robot Version	Reach	Payload	Armload
IRB 14000-0.5/0.5	500 mm	500 g	No armload

Features	
Integrated signal and power supply	24V Ethernet or 4 Signals
Integrated air supply	1 per Arm on tool Flange (4 Bar)
Integrated ethernet	One 100/10 Base-TX ethernet port/per arm
Position repeatability	0.02
Robot mounting	Table
Degree of protection	IP30
Controllers	Integrated

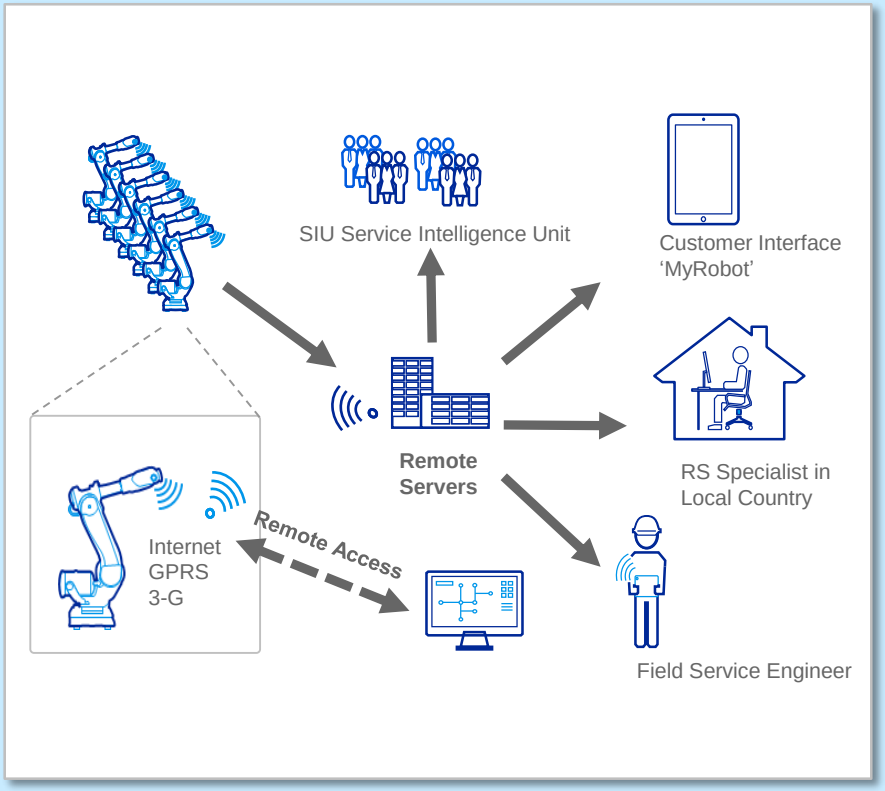
Safety specification	
Functional safety	PL b Cat B

ABB Robotics
Typical Robot Motion Capability

ABB Robotics
Customer Service: Remote Services Offering

Remote Services Portfolio

- Remote Support 24/7
  - Immediate support and reduced MTTR
- Remote Monitoring and Failure Prediction
  - Avoid unplanned stops and increase MTBF
- Remote Services Robot Back-up
  - Increase uptime and disaster recovery
- Remote Services Reporting @MyRobot
  - Information and reporting at your fingertips



Portfolio developed mainly for end-customers

ABB Robotic Teleoperation
Motivation

Converts an industrial robot into a remotely controlled power tool

- Uses the strength and accuracy of the robot for applications that cannot be programmed
- Removes user from hazardous environments and enables remote operation
- Increase the utilization of experts
- Example applications:
  - Local Operations: easily grind large, low volume castings in foundry production using a robot with a large grinding tool
  - Remote Operations: inspect, sample, push buttons, turn valves, pick up items, etc. at remote sites with a robot on a mobile platform
    - Oil & Gas
    - Mining

ABB Robotic Teleoperation
Lessons & Experience

Situational Awareness
- Is hard. Camera setup becomes complicated in order to cover the entire robot space
- Stereo (3D) vision helps a lot
- Immersive experience is too far away

QoS based Control
- Dedicated communication link is best for stability and performance
- Internet & wireless cause a lot of packet loss, jitter & delays. 5G is very promising
- QoS needs to vary gracefully with communication and operator

Ease of Use
- Hand eye calibration is required to reduce cognitive load
- Input devices are still lacking
- Semi-autonomous mode is best: human sets up the task, robot performs the task
- Learning from Demonstration can be applied here

Power and productivity
for a better world™

Everybody likes robots…